REMARKS

This application has been carefully reviewed in light of the Office Action dated July 14, 2004. Claims 1, 2, 4 to 10, 12 to 18, 20 to 26, 28, 29, 31 to 43, 45, 46, 48 to 53, 55, 56, 58 to 63, 65, 66 and 68 to 71 remain in the application, with Claims 3, 11, 19, 27, 30, 44, 47, 54, 57, 64, 67 and 72 to 74 having been cancelled. Claims 1, 9, 16, 24, 36 to 39, 42, 45, 48, 50, 52, 58, 60, 62, 65, 68 and 70 are the independent claims herein. Reconsideration and further examination are respectfully requested.

Claim 27 was objected to for an informality. Without conceding the correctness of the objection, Claim 27 has nonetheless been cancelled, thereby obviating the objection.

Claims 36 to 41 and 72 to 74 were rejected under 35 U.S.C. § 112, first paragraph, as allegedly not be described in the specification in such a manner as to enable one skilled in the art to make and use the invention. Without conceding the correctness of the rejection, Claims 72 to 74 have nonetheless been cancelled, thereby obviating their rejection. Claims 36 to 41 have been amended giving due consideration to the points noted in the Office Action. Withdrawal of the § 112, first paragraph, rejections is respectfully requested.

Claims 1 to 8, 26, 35, 36, 42 to 44 and 52 to 54 were rejected under 35 U.S.C. § 112, second paragraph, for the language "smaller" and "substantially smaller", Claims 1 to 23, 28 to 30, 35 to 38, 42 to 47, 52 to 54, 62 to 67 and 72 to 74 were rejected under § 112, second paragraph, for the term "visually unpleasing artifacts" being a subject term, and Claims 24 to 35, 39 to 41, 50, 51, 60 an 61 were rejected under § 112, second

paragraph, for an alleged lack of antecedence, and Claims 72 and 74 were rejected under §112, second paragraph, for allegedly not included a means for generating the claimed dot pattern. Without conceding the correctness of the rejections, the claims have been amended giving due consideration to the points noted in the Office Action and Claims 72 and 74 have been cancelled. Withdrawal of the § 112, second paragraph, rejections is respectfully requested.

Claims 16, 19 to 21, 23/16, 23/19 to 23/21 and 38 were rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by U.S. Patent No. 5,572,600 (Tajima). Claims 9, 11 to 13, 15/9, 15/11 to 15/13, 37, 45, 47, 55, 57, 65 and 67 were rejected under 35 U.S.C. § 103(a) over Tajima in view of U.S. Patent No. 5,745,660 (Kolpatzik), Claims 14 and 15/14 were rejected under § 103(a) over Tajima in view of Kolpatzik and further in view of U.S. Patent No. 5,526,438 (Barton), Claims 18 and 23/18 were rejected under § 103(a) over Tajima in view of U.S. Patent No. 5,583,660 (Rylander), Claims 22 and 23/22 were rejected under § 103(a) over Tajima in view of Barton, Claims 10, 15/10, 46, 56 and 66 were rejected under § 103(a) over Tajima in view of Kolpatzik and Rylander, Claims 1, 3, 5, 6, 8/1, 8/3, 8/5, 8/6, 36, 42, 44, 52, 54, 62 and 64 were rejected under § 103(a) over Tajima in view of Kolpatzik and further in view of U.S. Patent No. 5,543,941 (Parker), Claims 2, 8/2, 43, 53 and 63 were rejected under § 103(a) over Tajima in view of Kolpatzik, Parker and Rylander, Claims 4 and 8/4 were rejected under § 103(a) over Tajima in view of Kolpatzik and Parker and further in view of U.S. Patent No. 5,832,122 (Shimazaki), Claims 7 and 8/7 were rejected under § 103(a) over Tajima in view of Kolpatzik, Parker and Barton, Claims 17, 23/17, 48, 58 and 68 were rejected under § 103(a) over Tajima in view of Parker, Claims 49, 59 and 69 were rejected under § 103(a)

over Tajima in view of Parker and Shimazaki, Claims 24 to 28, 30 to 33, 35/24 to 35/28, 35/30 to 35/33, 39 to 41, 50, 51, 60, 61, 70 to 72 and 74 were rejected under § 103(a) over Tajima in view of Shimazaki, Claims 34 and 35/34 were rejected under § 103(a) over Tajima in view of Shimazaki and Barton, and Claims 29, 35/29 and 73 were rejected under § 103(a) over Tajima in view of Shimazaki and Rylander. Reconsideration and withdrawal of the rejections are respectfully requested.

The present invention generally concerns reproducing gray levels using a threshold matrix. According to one aspect of the invention,

Referring specifically to the claims, amended independent Claim 1 is a method of reproducing gray levels to represent the density of each pixel of an output image by binary or multivalue data based on a one-to-one correspondence of each pixel of an input image to each element of a threshold matrix (a mask), comprising the steps of providing non-blue noise properties for each respective gray level of a dot pattern generated in a pixel block of a standard size using the mask of a size corresponding to a size smaller than the standard size of the pixel block, and generating an output image with no moiré and/or certain repetitive pattern, when the input image undergoes a gray level reproducing process and the produced image is output by an output device.

Amended independent Claims 36, 42, 52 and 62 are apparatus, apparatus, threshold matrix, and computer-readable storage medium claims, respectively, that substantially correspond to Claim 1.

Amended independent Claim 9 is similar to Claim 1, but is more specifically directed to a method of reproducing gray levels to represent the density of each pixel of an output image by binary or multivalue data based on a one-to-one

correspondence of each pixel of an input image to each element of a threshold matrix (a mask), comprising the steps of providing non-blue noise properties for each respective gray level of a dot pattern generated by the single mask, and generating an output image with no moiré and/or certain repetitive pattern when the input image undergoes a gray level reproducing process and the produced image is output by an output device.

Amended independent Claims 37, 45, 55, and 65 are apparatus, apparatus, threshold matrix, and computer-readable storage medium claims, respectively, that substantially correspond to Claim 9.

Amended independent Claim 16 is a method of reproducing gray levels to represent the density of each pixel of an output image by binary or multivalue data based on a one-to-one correspondence of each pixel of an input image to each element of a threshold matrix (a mask), comprising the steps of providing a plurality of isolated spectra for a two-dimensional spatial frequency spectrum of an individual dot pattern generated by a single mask at each respective gray level, and generating an output image with no moiré and/or certain repetitive pattern when the input image undergoes a gray level reproducing process and the produced image is output by an output device.

Amended independent Claims 38, 48, 58, and 68 are apparatus, apparatus, threshold matrix, and computer-readable storage medium claims, respectively, that substantially correspond to Claim 16.

Amended independent Claim 24 is a method of representing the density of each pixel of an output image by binary or multivalue data based on a one-to-one correspondence of each pixel of an input image to each element of a threshold matrix (a mask), comprising the steps of composing the mask to have a size of an array of a plurality

of element masks, each of which are a same size as that of a mask used in a dispersed-dot dithering method, and generating a dot pattern by the mask, the dot pattern comprising (1) at least a set of element pixel blocks, each of which corresponds to each element mask and has the same dot distribution at each respective gray level, (2) weak irregularity (perturbation) or pseudoperiodicity introduced at a certain gray level, (3) an equal number of dots in every element pixel block at each respective gray level, and (4) an equal number of dots in four individual partial element pixel blocks each having a quarter size of an element pixel block at each respective (4n)th (n indicates a positive integer) gray level.

Amended independent Claims 39, 50, 60, and 70 are apparatus, apparatus, threshold matrix, and computer-readable storage medium claims, respectively, that substantially correspond to Claim 24.

The applied art, alone or in any permissible combination, is not seen to disclose or to suggest the features of the present invention. More particularly, with regard to Claims 1, 9, 36, 37, 42, 45, 52, 55, 62 and 65, the applied art is not seen to disclose or to suggest at least the feature of providing non-blue noise properties for each respective gray level of a dot pattern generated either by a single mask (Claims 9, 37, 45, 55 and 65) or generated in a pixel block of a standard size using the mask of a size corresponding to a size smaller than the standard size of the pixel block (Claims 1, 36, 42, 52 and 62), and generating an output image with no moiré and/or certain repetitive pattern when an input image undergoes a gray level reproducing process and the produced image is output by an output device.

Tajima is merely seen to disclose a method for automatically generating a minimum unit of a threshold value of a digital halftone screen. Three type of orthogonal

screens having different screen angles with respect to each other in a spatial frequency region are designed, and then the minimum unit of the threshold value is automatically generated in an image region. In columns 6 to 8 of Tajima, a halftone screen of approximately 15 degrees is represented in the spatial frequency region as follows:

$$\theta = \tan^{-1}(q / p) = 15\text{deg}$$

where p and q are integers of 1 or more. Tajima discloses that orthogonal screens having the screen angles (θ) of +/- 15 degrees and 45 degrees, respectively, are superimposed on each other so that a rosette pattern can be generated having double circular rings in the spatial frequency region. However, Tajima is not seen to disclose or to suggest the use of a threshold matrix having non-blue noise properties, and therefore, is not seen to disclose or to suggest at least the feature of providing non-blue noise properties for each respective gray level of a dot pattern generated either by a single mask (Claims 9, 37, 45, 55 and 65) or generated in a pixel block of a standard size using the mask of a size corresponding to a size smaller than the standard size of the pixel block (Claims 1, 36, 42, 52 and 62), and generating an output image with no moiré and/or certain repetitive pattern when an input image undergoes a gray level reproducing process and the produced image is output by an output device.

Kolpatzik is merely seen to disclose the use of quantization utilizing stochastic threshold arrays. The stochastic threshold arrays correspond to a dither matrix and points of the threshold array correspond to threshold values of the matrix. As described in column 6, within each stochastic threshold array group 24m, each threshold array store 24m(n), in turn, stores one of the stochastic threshold arrays generated by the

stochastic threshold array generation system 21 for the group's grain/mottle trade-off. Grain is an artifact caused by aggregated dots and mottle is an artifact caused by less aggregated or dispersed dots (see column 3). Therefore, "grain/mottle trade-off" in Kolpatzik merely means correlation between an aggregated/clustered-dot type stochastic threshold arrays and a dispersed-dot type stochastic threshold arrays. That is, there is no implicit or explicit basis indicating stochastic properties of stochastic threshold arrays is non-blue noise. Thus, even if Kolpatzik could have been combined with Tajima, the result still would not have disclosed or suggested at least the feature of providing non-blue noise properties for each respective gray level of a dot pattern generated either by a single mask (Claims 9, 37, 45, 55 and 65) or generated in a pixel block of a standard size using the mask of a size corresponding to a size smaller than the standard size of the pixel block (Claims 1, 36, 42, 52 and 62), and generating an output image with no moiré and/or certain repetitive pattern when an input image undergoes a gray level reproducing process and the produced image is output by an output device.

Parker is merely seen to disclose a method for rendering a halftone image of a gray scale image by utilizing a pixel-by-pixel comparison of the gray scale image against a blue noise mask. This method is for obtaining an image before quantized from a gray scale image (i.e., an image to which a halftone processing has already been applied). Thus, Parker discloses a blue noise mask and not a mask with non-blue noise properties. As such, any permissible combination of Tajima, Kolpatzik and Parker also would not have resulted in the feature of providing non-blue noise properties for each respective gray level of a dot pattern generated either by a single mask (Claims 9, 37, 45, 55 and 65) or generated in a pixel block of a standard size using the mask of a size corresponding to a

size smaller than the standard size of the pixel block (Claims 1, 36, 42, 52 and 62), and generating an output image with no moiré and/or certain repetitive pattern when an input image undergoes a gray level reproducing process and the produced image is output by an output device.

In view of the foregoing, amended independent Claims 1, 9, 36, 37, 42, 45, 52, 55, 62 and 65, as well as the claims dependent therefrom, are believed to be allowable over the applied art.

Turning to independent Claims 16, 38, 48, 58 and 68, the applied art is not seen to disclose or to suggest at least the feature of providing a plurality of isolated spectra for a two-dimensional spatial frequency spectrum of an individual dot pattern generated by a single mask at each respective gray level, and generating an output image with no moiré and/or certain repetitive pattern when the input image undergoes a gray level reproducing process and the produced image is output by an output device.

As stated above, Tajima is merely seen to disclose a method for automatically generating a minimum unit of a threshold value of a digital halftone screen, while Parker is merely seen to disclose a method for rendering a halftone image of a gray scale image by utilizing a pixel-by-pixel comparison of the gray scale image against a blue noise mask. However, neither Tajima or Parker, either alone or in combination, are seen to disclose or to suggest at least the feature of a plurality of isolated spectra for a two--dimensional spatial frequency spectrum of an individual dot pattern generated by a single mask at each respective gray level, and generating an output image with no moiré and/or certain repetitive pattern when the input image undergoes a gray level reproducing process and the produced image is output by an output device.

In view of the foregoing, independent Claims 16, 38, 48, 58 and 68, as well as the claims dependent therefrom, are believed to be allowable over the applied art.

Regarding amended independent Claims 24, 39, 50, 60 and 70, the applied art is not seen to disclose or to suggest at least the feature of composing a mask to have a size of an array of a plurality of element masks, each of which are a same size as that of a mask used in a dispersed-dot dithering method, and generating a dot pattern by the mask, the dot pattern comprising (1) at least a set of element pixel blocks, each of which corresponds to each element mask and has the same dot distribution at each respective gray level, (2) weak irregularity (perturbation) or pseudoperiodicity introduced at a certain gray level, (3) an equal number of dots in every element pixel block at each respective gray level, and (4) an equal number of dots in four individual partial element pixel blocks each having a quarter size of an element pixel block at each respective (4n)th (n indicates a positive integer) gray level.

As stated above, Tajima is merely seen to disclose a method for automatically generating a minimum unit of a threshold value of a digital halftone screen. However, Tajima is not seen to disclose or to suggest at least the feature of composing a mask to have a size of an array of a plurality of element masks, each of which are a same size as that of a mask used in a dispersed-dot dithering method, and generating a dot pattern by the mask, the dot pattern comprising (1) at least a set of element pixel blocks, each of which corresponds to each element mask and has the same dot distribution at each respective gray level, (2) weak irregularity (perturbation) or pseudoperiodicity introduced at a certain gray level, (3) an equal number of dots in every element pixel block at each respective gray level, and (4) an equal number of dots in four individual partial element

pixel blocks each having a quarter size of an element pixel block at each respective (4n)th (n indicates a positive integer) gray level.

Shimazaki is merely seen to disclose generating a halftone dot image of which tones are free from image degradation due to a dot gain. Shimazaki obtains a visual point spread function by applying a two-dimensional Fourier transform to visual spatial frequency characteristics (MTF). Then, applying the visual point spread function to positions corresponding to the positions of thresholds in order to determine a hypothetical distribution of densities of an image produced by the thresholds. Finally, an unwanted granularity is reduced by establishing threshold matrices in order to minimize the variation of the hypothetical distribution of densities. However, Shimizaki is not seen to disclose or to suggest at least the feature of composing a mask to have a size of an array of a plurality of element masks, each of which are a same size as that of a mask used in a dispersed-dot dithering method, and generating a dot pattern by the mask, the dot pattern comprising (1) at least a set of element pixel blocks, each of which corresponds to each element mask and has the same dot distribution at each respective gray level, (2) weak irregularity (perturbation) or pseudoperiodicity introduced at a certain gray level, (3) an equal number of dots in every element pixel block at each respective gray level, and (4) an equal number of dots in four individual partial element pixel blocks each having a quarter size of an element pixel block at each respective (4n)th (n indicates a positive integer) gray level.

In view of the foregoing, independent Claims 24, 39, 50, 60 and 70, as well as the claims dependent therefrom, are believed to be allowable over the applied art.

The other applied references, namely Rylander and Barton, have been studied but are not seen to add anything that, when combined with any of Tajima,

Kolpatzik, Parker, and Shimazaki, would have disclosed or suggested any of the foregoing features of independent Claims 1, 9, 16, 24, 36 to 39, 42, 45, 48, 50, 52, 55, 58, 60, 62, 65, 68 and 70.

In view of the foregoing amendments and remarks, the entire application is believed to be in condition for allowance and such action is respectfully requested at the Examiner's earliest convenience.

Applicant's undersigned attorney may be reached in our Costa Mesa, California office at (714) 540-8700. All correspondence should continue to be directed to our below-listed address.

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